479588-11-1-TM

DATATAPE®

12-478C-2 VOICE LOGGING UNIT

TECHNICAL MANUAL

BELL & HOWELL
DATATAPE DIVISION
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SECTION I

GENERAL DESCRIPTION

1-1. GENERAL.

1-2. The Bell & Howell 12-478C-2 Voice Logging Unit is available as an optional item for the Bell & Howell 4020A Magnetic Tape Record/Reproduce System. The voice logging unit may be used to record and reproduce voice commentary on a special track at the edge of the tape.

1-3. EQUIPMENT DESCRIPTION.

1-4. The 12-478C-2 Voice Logging Unit includes a special transport control panel, a microphone, and a voice logging amplifier assembly.

1-5. Figure 1-1 is a photograph of the 12-478C-2 Voice Logging Amplifier Unit. The amplifier consists of a double-sided circuit card and control panel. It includes record, bias, and reproduce circuits. The record electronics are enabled by a push-to-talk button on the microphone. Voice information can be recorded any time the transport is in a run mode. Commentary will be reproduced in the run modes whenever the amplifier volume control is advanced, provided the push-to-talk microphone button is not depressed.

1-6. The voice logging amplifier is installed with the signal electronics in the third position of the amplifier case assembly. A loudspeaker assembly is located behind a grille at the top of the transport control panel.

1-7. Typical performance data for the 12-478C-2 Voice Logging Unit is given in table 1-1.

CHARACTERISTIC	TYPICAL PERFORMANCE
Input Signal Source	High impedance (500K ohms) ceramic microphone.
Frequency Response	300 Hz to 3000 Hz
Bias Signal (12-478C-2, 12-478C-5)	2 MHz
Bias Signal (12-478C-12, 12-478C-15)	4 MHz
Recording Speed Range	15/16 ips to 60 ips.
Operating Power Source	±15 Vdc supply from the system power supply.

Table 1-1. Typical Performance Data for the 12-478C-2 Voice Logging Unit

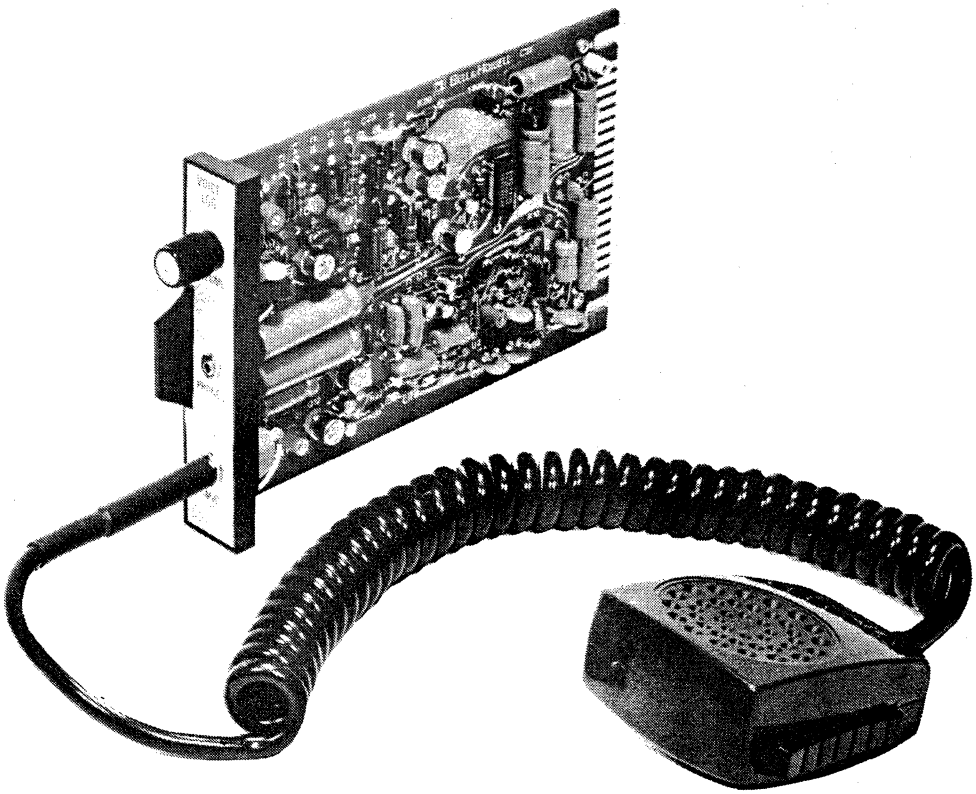


Figure 1-1. 12-478C-2 Voice Logging Amplifier Unit

SECTION II

INSTALLATION

2-1. GENERAL.

2-2. The 12-478C-2 Voice Logging Unit is normally furnished installed in the 4020A Magnetic Tape Record/Reproduce System, ready for operation. However, the components are available as a kit which may be installed in the field by following the procedure in paragraph 2-3.

2-3. INSTALLATION OF THE 12-478C-2 VOICE LOGGING UNIT.

2-4. The voice logging unit includes a special transport control panel. Figure 6-1 illustrates the Voice Logging Printed circuit card. After removing the standard control panel, secure the speaker assembly to the upper left hand side of the control panel frame, using two flat head 4-40 screws through the existing holes. Install the new control panel with the speaker grille. Connect the two leads and connector (A1P24) from the speaker to connector (A1J24) mounted on the left hand handle assembly.

2-5. The 12-478C-2 Voice Logging Unit includes one amplifier circuit card. The circuit card is installed in the third position of the amplifier case assembly.

2-6. The system power should be turned off before installing or removing an amplifier circuit card from an amplifier case. The card is installed by placing it in the appropriate guide slots of the amplifier case and sliding it in until the pins mate firmly with the mating connector.

SECTION III

OPERATION

3-1. GENERAL.

3-2. The 12-478C-2 Voice Logging Unit is fully operational once the installation procedures contained in Section II of the system manual have been completed and power is applied to the system. Refer to Section III of the system manual for the operational procedures for the 12-478C-2 Voice Logging Unit.

SECTION IV

THEORY OF OPERATION

4-1. GENERAL.

4-2. The 12-478C-2 Voice Logging Unit includes a push-to-talk microphone and one circuit card. These components are shown in figures 1-1 and 6-1.

4-3. Figure 4-1 is a block diagram of the voice logging circuitry. The circuit card assembly contains the record and reproduce amplifiers. The voice signal from the microphone is amplified, linearly mixed with a high frequency bias signal, and applied to the record head voice track winding. The reproduced signal is amplified, equalized, and applied to the loudspeaker assembly. Figure 7-1 is the schematic diagram of the voice logging unit.

4-4. RECORD ELECTRONICS.

4-5. MICROPHONE. A hand-held mobile type microphone with a high impedance ceramic element is used. It is equipped with a double-pole push-to-talk switch. Pressing the switch removes a short circuit across the microphone element and closes another set of contacts which are used to energize a record relay on the circuit card.

4-6. RECORD AMPLIFIER. The audio signal from the microphone element is coupled through capacitor C1 to the noninverting input of integrated circuit amplifier U1. The output of amplifier U1 is connected to the base of transistor Q1. Transistor Q1 is connected as an emitter-follower to provide a low impedance drive source for the record head. Negative feedback is provided from the emitter of transistor Q1 through resistor R6 to the inverting input of integrated circuit U1. The amount of ac feedback is controlled by potentiometer R4 to establish the gain of the record amplifier stage. The record amplifier output may be monitored at test point TP1.

4-7. BIAS AMPLIFIER. An input square wave bias signal (4 MHz) from the control logic circuit card in the transport is routed to connector pin 10 on the voice logging amplifier circuit card. The bias signal is coupled through capacitor C28 to the base of transistor Q8. Transistor Q8 drives the base of transistor Q7. Transistor Q7 amplifies the bias signal from transistor Q8 and drives the complementary emitter-follower circuit consisting of transistors Q5 and Q6. The output from the bias amplifier is taken from the junction of the emitters of transistors Q5 and Q6. At this point, the signal is a high amplitude, nominal square wave. A resonant circuit consisting of capacitor C16 and inductor L4 is in series with the amplifier output. It is parallel resonant at the second harmonic of the input bias frequency. This provides a very high impedance to the second harmonic which effectively removes the undesirable even-order harmonics from the bias. At the same time, the combination of capacitors C13 and C16 and inductor L4 is series resonant at the bias frequency to minimize attenuation of the fundamental. The bias signal at the output of the second harmonic trap is coupled by capacitor C13 to another parallel resonant circuit, consisting of capacitor C10 and inductor L2, which is resonant at the bias frequency. The bias signal is developed across the parallel combination of capacitor C10, inductor L2, and potentiometer R15 while the significant even-order

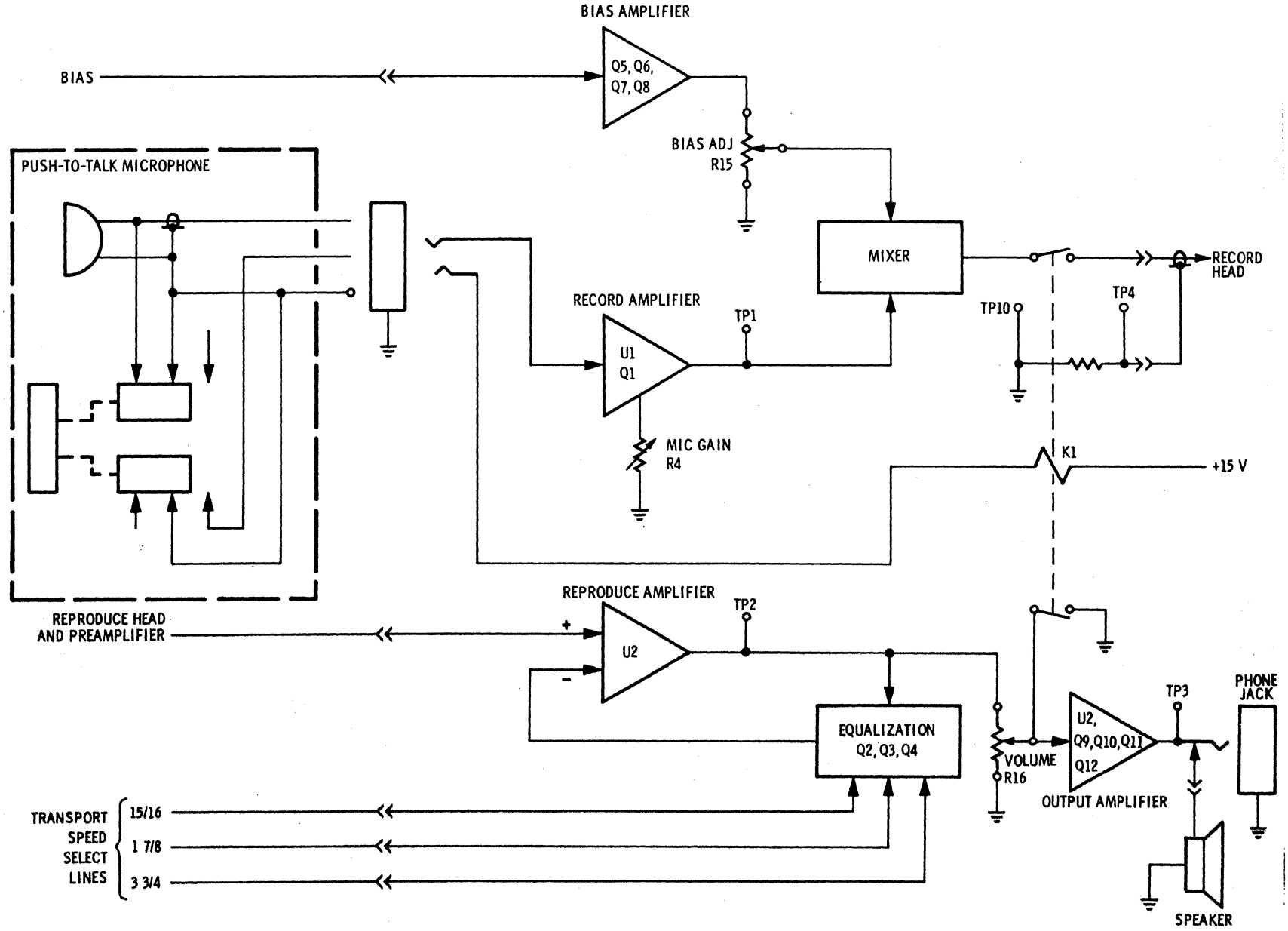


Figure 4-1. Block Diagram, Voice Logging Unit

harmonics are greatly attenuated. Potentiometer R15 determines the amplitude of the bias signal coupled through capacitor C18 to the mixer summing point.

4-8. MIXER. The data signal and the bias are linearly mixed at the mixer summing point, which is the junction of capacitor C18 and the parallel combination of capacitor C15 and inductor L3. Capacitor C15 and inductor L3 are in series with the data signal line from the record amplifier. The circuit is parallel resonant at the bias frequency and serves to prevent bias from coupling back from the summing point to the record amplifier. An additional bias trap consisting of capacitor C12 and inductor L1 further reduces bias feedback. The audio signal from the output of the record amplifier is coupled through capacitor C9, resistor R11, and the C15/L3 bias trap to the mixer summing point. After mixing, the composite audio/bias signal is fed to normally open contacts of the record relay, K1. Terminal 2 of the relay coil is connected through resistor R34 to the +15 volt power line. When the push-to-talk button on the microphone is pressed, coil terminal 6 is grounded and the relay energizes. The closed relay contacts allow the audio/bias signal to be routed through terminal A of the printed circuit card connector to the voice record head winding. The head winding is returned via terminal 2 through a 10 ohm resistor, R35, to ground. The record head signal may be monitored by observing the voltage developed across R35 at test point TP4.

4-9. REPRODUCE ELECTRONICS.

4-10. REPRODUCE AMPLIFIER. The reproduced audio signal from the reproduce head voice winding and the reproduce preamplifier is connected to terminals F and H of the printed circuit card connector. From the input terminal, the signal is coupled through capacitors C37 and C38 to the differential input pins 6 and 5, respectively, of integrated circuit linear amplifier U1 (1/2). The output of the differential amplifier is taken from pin 1 and coupled through capacitors C2 and C7 to U2-9. The output of this linear amplifier is taken from terminal 13 and coupled through capacitor C17 to the front panel volume control, R16. Test point TP2 allows the amplifier output to be monitored.

4-11. Negative feedback through the parallel combination of capacitor C8 and resistor R8 to the inverting input of U2-8 provides a 6 dB per octave roll-off needed to compensate for the reproduce head response. Transistor Q2, Q3, or Q4 is turned on at each of the three lower speeds to shunt a portion of the negative feedback to ground through resistor R14 and capacitor C11, C14, or C19. The shunt RC network increases the amplifier gain at the higher frequencies where the reproduce head response falls off.

4-12. REPRODUCE OUTPUT AMPLIFIER. The input signal to the output amplifier circuit is taken from the wiper of the volume control, R16. Normally open contacts of the record relay, K1, short the audio signal to ground when the voice logging assembly is in the record mode. The first stage of the output amplifier consists of integrated circuit linear amplifier U2 (1/2). The output is coupled through diodes CR1, CR2, CR3, and CR4 to the bases of complementary emitter-follower driver transistors Q9 and Q10. The four diodes provide proper dc bias levels for the transistors to prevent crossover distortion when the output signal changes polarity. Transistors Q9 and Q10 provide base currents to the output complementary emitter-follower transistors Q11 and Q12, respectively. The output is taken from the

junction of the emitter resistors, R32 and R33, and may be monitored at test point TP3. Negative feedback for stability is provided from this point through resistor R24 to the inverting input of the linear amplifier. The complementary emitter-follower output is coupled through capacitor C35 to a closed circuit phone jack (J2) on the front panel. If headphones are not inserted in jack J2, the audio signal is routed to the loudspeaker assembly in the transport control panel. When headphones are used, the speaker is automatically disconnected.

SECTION V

CALIBRATION AND MAINTENANCE

5-1. GENERAL.

5-2. This section of the manual consists of preventive maintenance, calibration procedures, and troubleshooting and corrective maintenance.

5-3. PREVENTIVE MAINTENANCE.

5-4. Preventive maintenance consists of general cleaning and periodic inspection. Accumulation of dirt, dust, grit, and/or grease is harmful and should be guarded against by periodic inspection and cleaning. Every three months, inspect the circuit card for signs of deterioration, loose connections, insecurity of mounting, and foreign matter. The period of cleaning depends on the particular operating environment and should be determined by inspection. As necessary, clean the circuit card with a soft brush, low air pressure, or suitable solvent, being careful not to damage the printed circuitry.

5-5. CALIBRATION PROCEDURES.

5-6. The calibration procedure is done with an operable tape system. Make the adjustments as follows:

a. Prepare the tape system for operation as described in the tape system operation and maintenance manual.

b. With the tape system turned off, place the amplifier on an extender card.

c. Connect the microphone into the front panel phone jack (J1).

d. Connect an oscilloscope to TP1 (brown).

e. Set the tape speed switch to any speed. (Usually a low speed such as 3-3/4 ips or 7-1/2 ips is convenient.)

f. Energize the tape transport and operate in RUN mode.

g. Press the push-to-talk button on the microphone and speak into the microphone at normal voice level.

h. Observe the oscilloscope and adjust gain control R4 on the voice logging circuit card until voice signal peaks reach approximately 8-10 volts peak-to-peak.

i. Connect the oscilloscope to TP4 (yellow).

j. Adjust the bias potentiometer R15 for 400 mV p-p.

k. Turn the tape system off and disconnect the oscilloscope, remove the extender card, and insert the voice logging circuit card back into the system. This completes the adjustment procedure.

5-7. TROUBLESHOOTING AND CORRECTIVE MAINTENANCE.

5-8. Before attempting to repair a unit suspected of a malfunction, verify that the symptom is not caused by the malfunction of associated equipment such as the power supply, the mother board assembly, or intercabling errors. This can be done by substituting a known good unit for the suspected one, or making continuity checks within the unit.

5-9. Once the existence of a defective unit has been established, check it for obvious signs of damaged components, such as burned resistors, or incorrect seating of components. The next step is to check that the proper supply voltage is reaching the unit. If the supply voltage is correct, the faulty stage within the unit can be located by tracing the signals from stage to stage.

5-10. Once the defective stage has been located, the defective components in that stage can be determined by reference to the schematic diagram and by making continuity, voltage, and/or resistance measurements about the suspected components. The prime exception to this is open coupling capacitors, which should be checked by substitution, or by adding a test capacitor in parallel.

CAUTION

Do not connect an ohmmeter directly across the winding of the head assembly. The presence of dc current will not only magnetize the heads, but may damage the windings.

5-11. REPAIR.

5-12. Repair of the unit should be attempted only by an electronics technician or personnel experienced in printed wiring techniques. Recommended repair is limited to replacement of defective components and adjustment of controls. When removing and replacing defective components, care should be exercised so as not to damage surrounding components or the circuit card. Replacement parts must be of the correct type and value, as listed in the parts list in Section VI. When installing a new part, place it in the exact position of the replaced part. After replacement, carefully inspect the circuit card for evidence of cold solder joints, solder splashes, and insecurity of mounting. If the unit is repaired, it should be checked and adjusted as described in the adjustment procedure.

5-13. PARTS IDENTIFICATION.

5-14. Components of the 12-478C-2 Voice Logging Unit are illustrated and listed in Section VI. The parts list itemizes the component parts of the unit and provides the Bell & Howell part number for each component of the amplifier assembly.

5-15. FIELD REPAIR SERVICE.

5-16. Refer to section V of the system manual for field repair service information.

5-17. FACTORY REPAIR SERVICE.

5-18. Refer to Section V of the system manual for factory repair service information.

SECTION VI

PARTS LIST

6-1. GENERAL.

6-2. An appropriate parts list and illustration for the Voice Logging Unit, Bell & Howell part number 479588-0011, covered by this manual follow the instructions given below. The parts list (table 6-1) includes Bell & Howell DATATAPE Division part number, description, figure and index and/or schematic reference symbol, and where applicable, the manufacturer's or military part number for each component.

6-3. MANUFACTURER'S CODES.

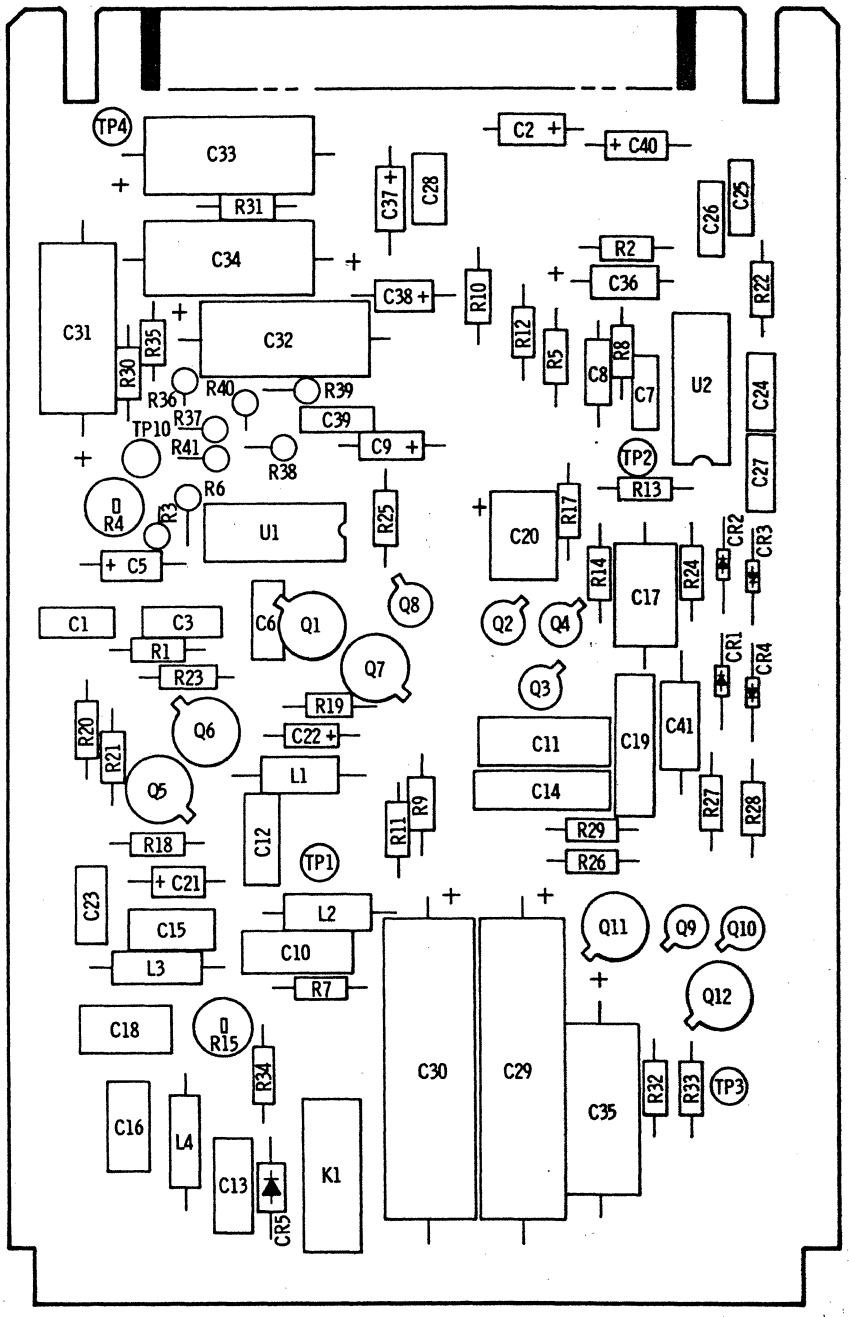
6-4. Manufacturer's code symbols used in the parts list are tabulated in the System manual with the manufacturer's name and address. All code symbols are in accordance with the Federal Supply Code for Manufacturers Cataloging Handbooks H 4-1 and H 4-2.

6-5. ORDERING REPLACEMENT PARTS.

6-6. When ordering replacement parts refer to Section VI of the System manual for ordering instructions.

6-7. PARTS LOCATION ILLUSTRATIONS.

6-8. Figure 6-1 illustrates the location of components on the circuit card.



D-475310-K (REF)

Figure 6-1. Voice Logging Printed Circuit Card, Component Location

Table 6-1. Parts List for the 479588-0011 Voice Logging Unit (Sheet 1 of 5)

ITEM NO.	B&H PART NO.	DESCRIPTION 0 1 2 3 4 5 6	QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
1	479588-0011	Voice Logging Unit	1		14028	
2	475313	Microphone Assembly	1			
3	378637	Microphone	1	MK1/S1	70638	531
4	475012-0003	Plug, telephone 3 conductor	1	P1	82389	TT-253
5	475314-0001	Amplifier Assembly, voice logger	1		14028	
6	475309	Panel Assembly, front	1		14028	
7	475007-0003	Jack, telephone	1	J1	82389	UJ-2B
8	475007-0002	Jack, telephone	1	J2	82389	TR-2A
9	532862-1011	Res, var (modified)	1	R16	14028	
10	379494-0003	Panel, front, amplifier module	1			
11	475233-0001	Knob	1		86797	RB-67-0-DC-M-.125 SHAFT
12	379495	Plate, electrical, shield	1			
13	475310-0002	Circuit Card Assembly, voice logger	1	6-1	14028	
14	246954	Diode, signal switching 25 V	4	CR1,2, CR3,4	03508	1N4154

Table 6-1. Parts List for the 479588-0011 Voice Logging Unit (Sheet 2 of 5)

ITEM NO.	B&H PART NO.	DESCRIPTION 0 1 2 3 4 5 6	QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
				6-1		
1	372295-0002	Diode, rectifier 1.0A, 200 V	1	CR5	04713	1N4003
2	202790-0018	Cap, fixed, ceramic 0.01 uF ±20%, 100 Vdc	10	C1,6,7, C23 thru C28,39	56289	TG-S10
3	70094-0040	Cap, fixed, mica 330 pF ±5%, 500 Vdc	1	C10	93790	CD15F331J03-500WV
4	371916-0035	Cap, fixed, mylar 0.039 uF ±10%, 100 Vdc	1	C11	56289	225P39391WD3
5	70094-0023	Cap, fixed, mica 68 pF ±5%, 500 Vdc	3	C12,13, C15	93790	CD15E680J03-500WV
6	371916-0023	Cap, fixed, mylar, 0.015 uF ±10%, 100 Vdc	1	C14	56289	225P15391WD3
7	70094-0012	Cap, fixed, mica 27 pF ±5%, 500 Vdc	1	C16	93790	CD15E270J03-500WV
8	215095-0492	Cap, fixed, mylar 0.1 uF ±10%, 80 V	1	C17	56289	192P1049R8
9	70094-0031	Cap, fixed, mica 150 pF ±5%, 500 Vdc	1	C18	93790	CD15F151J03-500WV
10	371916-0017	Cap, fixed, mylar 0.0068 uF ±10%, 100 Vdc	1	C19	56289	225P68291WD3
11	471863-0004	Cap, fixed, tantalum 10.0 uF ±20%, 20 Vdc	7	C2,5,9, C36,37, C38,40	31433	T320B106-M20AS
12	471920-0007	Cap, fixed, tantalum 68 uF ±20%, 25 Vdc	1	C20	05397	T362-D-686-M-025-AS
13	471863-0006	Cap, fixed, tantalum 2.2 uF ±20%, 25 Vdc	2	C21,22	31433	T320A225-M25AS

Table 6-1. Parts List for the 479588-0011 Voice Logging Unit (Sheet 3 of 5)

ITEM NO.	B&H PART NO.	DESCRIPTION 0 1 2 3 4 5 6	QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
				6-1		
1	471930-0009	Cap, fixed, electrolytic 500 uF -10 +75%, 16 V	2	C29,30	14655	NLW 500-16
2	70094-0045	Cap, fixed, mica 500 pF ±5%, 500 Vdc	1	C3	93790	CD15F501J03-500WV
3	471930-0003	Cap, fixed, electrolytic 100 uF -10 +75%, 16 V	5	C31,32, C33,34, C35	14655	NLW 100-16
4	215095-0502	Cap, fixed, mylar 0.068 uF ±10%, 80 V	1	C41	56289	192P6939R8
5	215095-0552	Cap, fixed, mylar 0.0047 uF ±10%, 80 V	1	C8	56289	192P4729R8
6	472460-1202	Relay, reed	1	K1	15636	RA30382121
7	472466-0005	Inductor, fixed, shielded 22 uH ±10%	2	L1,3	76493	9250-223
8	472466-0072	Inductor, fixed, shielded 4.7 uH ±10%	1	L2	76493	9250-472
9	472466-0003	Inductor, fixed, shielded 15 uH ±10%	1	L4	72259	SWD-15
10	471927	Transistor, NPN	3	Q1,5,7	04713	2N2219
11	246014-0001	Transistor, NPN, power	1	Q11	86684	2N3053
12	212696	Transistor, PNP	1	Q12	04713	2N4890
13	471926	Transistor, NPN	3	Q2,3,4	04713	2N2369
14	471925	Transistor, PNP	1	Q6	04713	2N2905

Table 6-1. Parts List for the 479588-0011 Voice Logging Unit (Sheet 4 of 5)

ITEM NO.	B&H PART NO.	DESCRIPTION 0 1 2 3 4 5 6	QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
				6-1		
1	471931	Transistor, PNP	2	Q8,10	04713	2N3251
2	471472	Transistor, NPN	1	Q9	04713	2N3947
3	70083-4745	Res, fixed, composition 470K ohm ±5%, 1/4 W	2	R1,6	81349	RCR07G474JS
4	471922-4732	Res, fixed, metal oxide 47K ohm ±2%, 1/4 W	3	R10,12, R17	24546	C4-47K OHM 2PCT
5	471922-1022	Res, fixed, metal oxide 1K ohm ±2%, 1/4 W	5	R11,20, R21,36, R39	24546	C4-1K OHM 2PCT
6	471922-4722	Res, fixed, metal oxide 4.7K ohm ±2%, 1/4 W	1	R13	24546	C4-4.7K OHM 2PCT
7	471922-2012	Res, fixed, metal oxide 200 ohm ±2%, 1/4 W	1	R14	24546	C4-200 OHM 2PCT
8	471922-1002	Res, fixed, metal oxide 10 ohm ±2%, 1/4 W	3	R18,19, R35	24546	C4-10 OHM 2PCT
9	471922-2042	Res, fixed, metal oxide 200K ohm ±2%, 1/4 W	2	R2,8	24546	C4-0.20 MEG OHM 2PCT
10	471922-1032	Res, fixed, metal oxide 10K ohm ±2%, 1/4 W	7	R22,23, R25,27, R28,40, R41	24546	C4-10K OHM 2PCT
11	471922-1042	Res, fixed, metal oxide 100K ohm ±2%, 1/4 W	1	R24	24546	C4-100K OHM 2PCT
12	471922-3302	Res, fixed, metal oxide 33 ohm ±2%, 1/4 W	4	R26,29, R30,31	24546	C4-33 OHM 2PCT
13	471922-2022	Res, fixed, metal oxide 2K ohm ±2%, 1/4 W	2	R3,7	24546	C4-2K OHM 2PCT

Table 6-1. Parts List for the 479588-0011 Voice Logging Unit (Sheet 5 of 5)

ITEM NO.	B&H PART NO.	DESCRIPTION 0 1 2 3 4 5 6	QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
				6-1		
1	70083-5195	Res, fixed, composition 5.1 ohm ±5, 1/4 W	2	R32,33	81349	RCR07G5R1JS
2	471922-1012	Res, fixed, metal oxide 100 ohm ±2%, 1/4 W	1	R34	24546	C4-100 OHM 2PCT
3	471922-5122	Res, fixed, metal oxide 5.1K ohm ±2%, 1/4 W	2	Rr37,38	24546	C4-5.1K OHM 2PCT
4	366427-0010	Res, var, cermet 20K ohm ±20%, 1/2 W	2	R4,152,	32997	3339P-1-103
5	471922-3312	Res, fixed, metal oxide 330 ohm ±2%, 1/4 W	1	R5	24546	C4-330 OHM 2PCT
6	471922-7522	Res, fixed, metal oxide 7.5K ohm ±2%, 1/4 W	1	R9	24546	C4-7.5K OHM 2PCT
7	376087-0001	Connector, (vertical jack) brown	1	TP1	74970	105-858
8	376087-0010	Connector, (vertical jack) black	1	TP10	74970	105-853
9	376087-0002	Connector, (vertical jack) red	1	TP2	74970	105-852
10	376087-0003	Connector, (vertical jack) orange	1	TP3	74970	105-856
11	376087-0004	Connector, (vertical jack) yellow	1	TP4	74970	105-857
12	475224	Integrated Circuit	2	U1,2	04713	MC1303L
13	475310	Board, printed wiring	1		14028	
14	126716-0174	Cable, rf, coaxial	A/R		81349	RG/174A/U

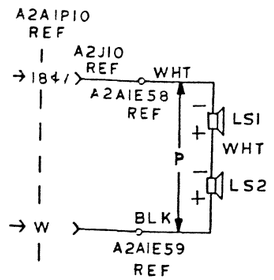
SECTION VII

SCHEMATICS

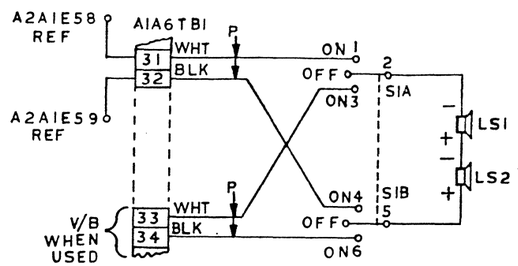
7-1. GENERAL.

7-2. This section contains the schematic diagram (figure 7-1) for the 12-478C-2 Voice Logging Unit.

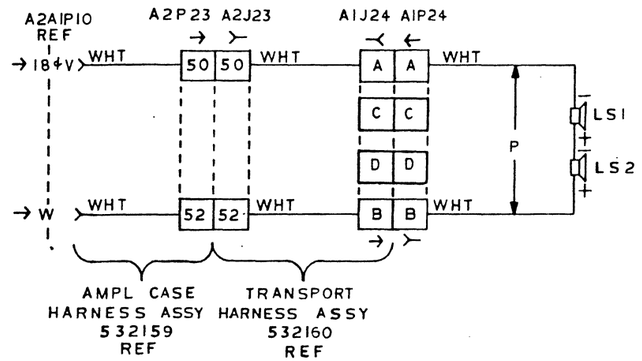
SPEAKER WIRING
FOR CPR 4000



SPEAKER WIRING
FOR CPR 4010



SPEAKER WIRING FOR CPR 4020



④ BAND	INTERMEDIATE	WIDE
COMPONENT DESIGNATION	D-475308(BASIC) (12-478C -2&-5)	D-475308-0001 (12-478C-12&-15)
R23	33 K	10K
C10	1300 pf	330pf
C12,13,15	150pf	68pf
C16	47 pf	27pf
L1, 3	47μH±10%	22μH±10%
L4	33μH±10%	15μH±10%
R15	1K±20% 1/2W	10K±20% 1/2W

LAST COMPONENT DESIGNATION USED
R41, C40, L4, CR5, K1, Q12, P1, E11, J2, U2, TP10, MK1, S1, LS2

COMPONENT DESIG. OMITTED
TP5 THRU TP9, C4

④ 475308(BASIC) NEXT ASSY IS D 475310-0001
475308-0001 NEXT ASSY IS D 475310-0002

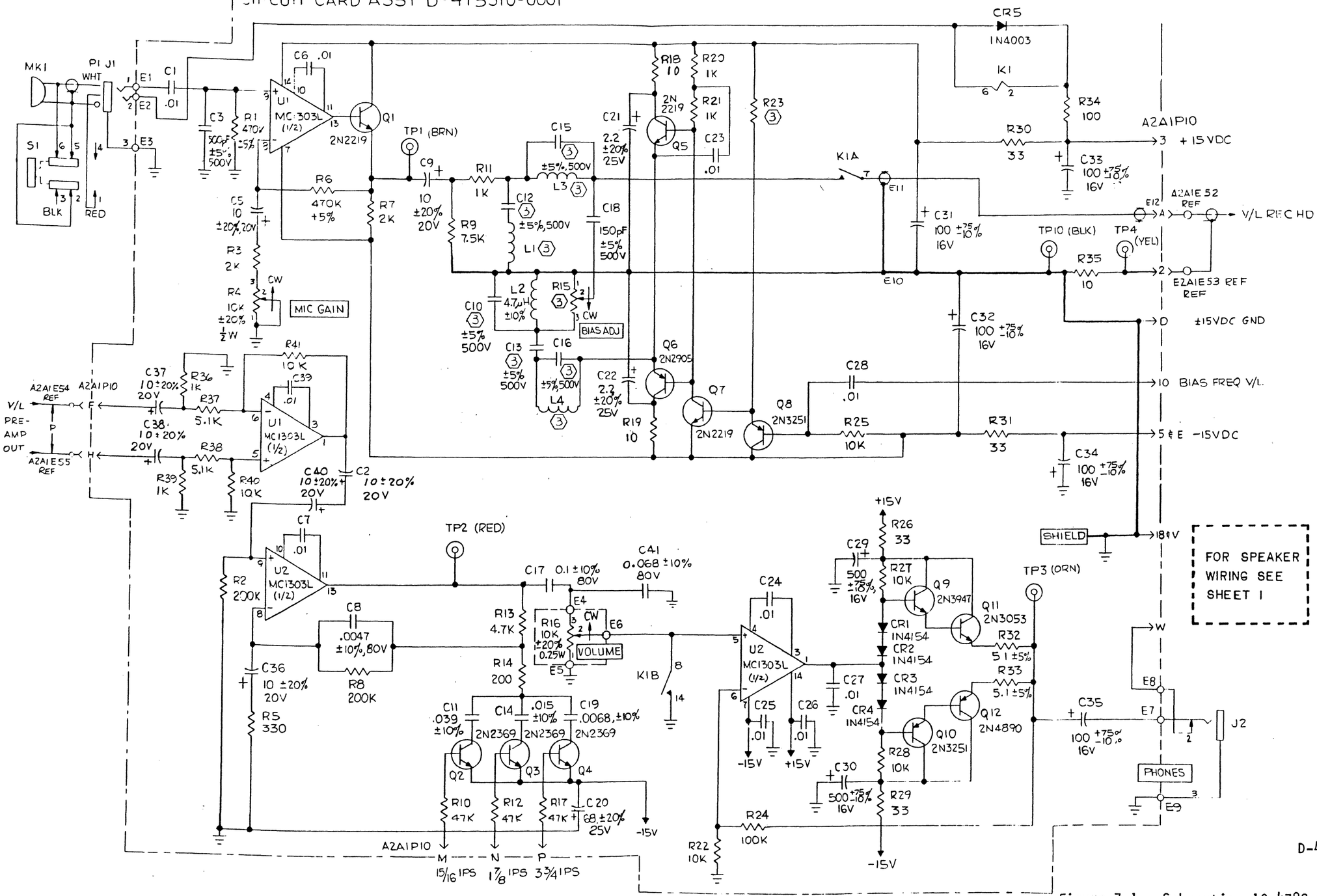
③ SEE TABULATION FOR COMPONENT VALUES.
2. ALL CAPACITORS ARE IN μF $^{+80\%}_{-20\%}$ 100V.
1. ALL RESISTORS ARE IN OHMS, ±2%, 1/4W.

NOTES:

D-475308-K (REF)

7-1. Schematic, 12-478C-2 Voice Logger Unit (Sheet 1 of 2)

CIRCUIT CARD ASSY D-475310-0001



D-475308-K (REF)

Figure 7-1. Schematic, 12-478C-2 Voice Logger Unit (Sheet 2 of 2)